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(54) **TIRE WITH MONITORING DEVICE**

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(63) Continuation of application No. 11/593,687, filed on Nov. 7, 2006, now Pat. No. 7,592,902, which is a continuation of application No. 11/155,233, filed on Jun. 17, 2005, now Pat. No. 7,132,930, which is a continuation of application No. 09/793,253, filed on Feb. 26, 2001, now Pat. No. 6,919,799, which is a continuation-in-part of application No. 09/301,793, filed on Apr. 29, 1999, now Pat. No. 6,208,244.

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(52) **U.S. Cl.** **340/426.33**; 340/442; 340/443; 340/444; 340/447; 73/146.5

(58) **Field of Classification Search** 340/426.33, 340/442, 443, 444, 445, 446, 447; 73/146.5, 73/146

See application file for complete search history.

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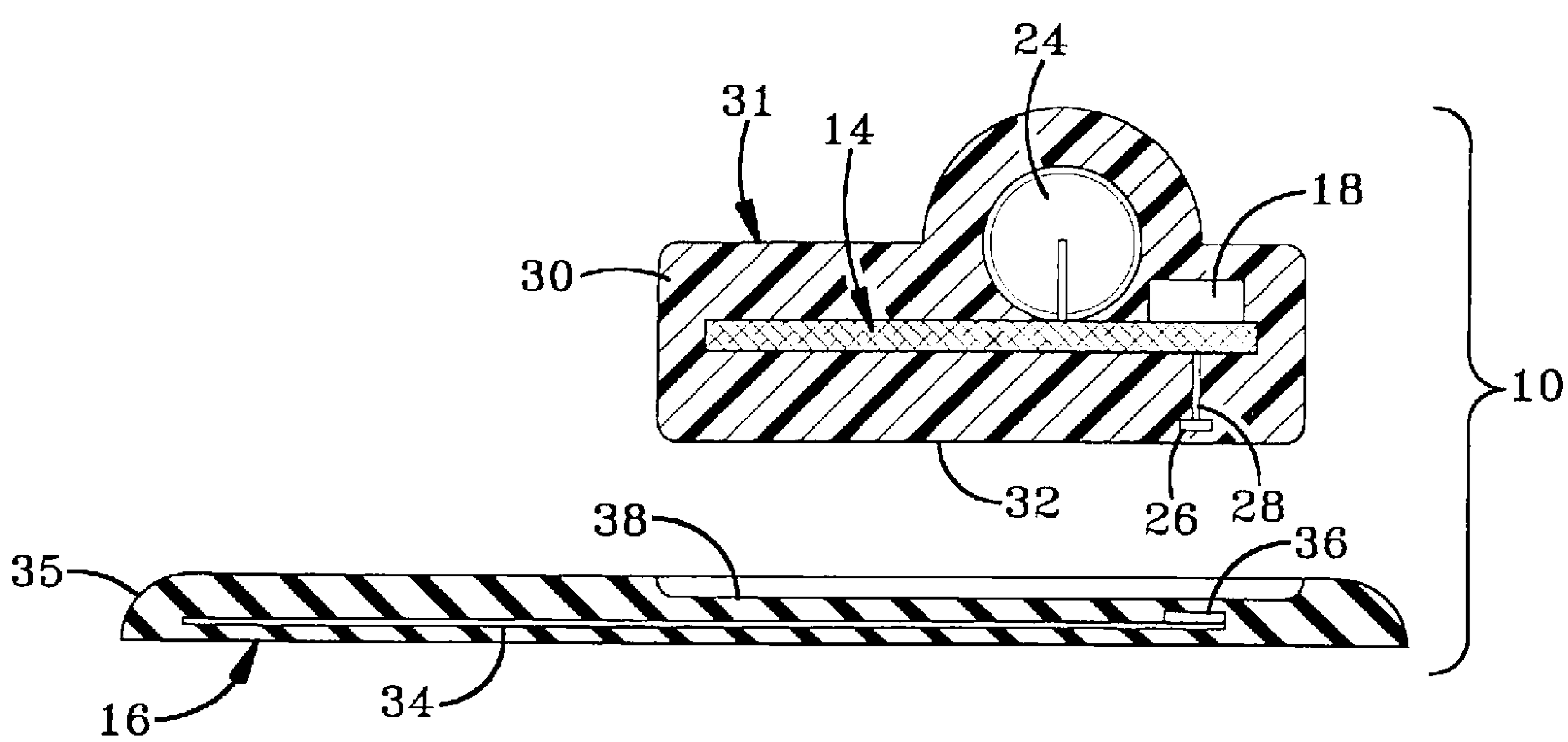
(57) **ABSTRACT**

The invention provides a monitoring device and tire combination wherein an antenna is mounted to the tire in a location spaced from the monitoring device. In one embodiment, the antenna may be mounted to the tire sidewall outside the body cords of the tire. The antenna may be mounted on the outer surface of the sidewall or embedded within the body of the sidewall. The antenna is connected to the monitoring device with a connector. The connector may be electrically coupled to the monitoring device or may be connected to the monitoring device with a plug and socket connection. When the antenna is outside the body cord, the connector may extend from the antenna through the bead filler, over the top of the turn up, or under the bead ring.

25 Claims, 7 Drawing Sheets



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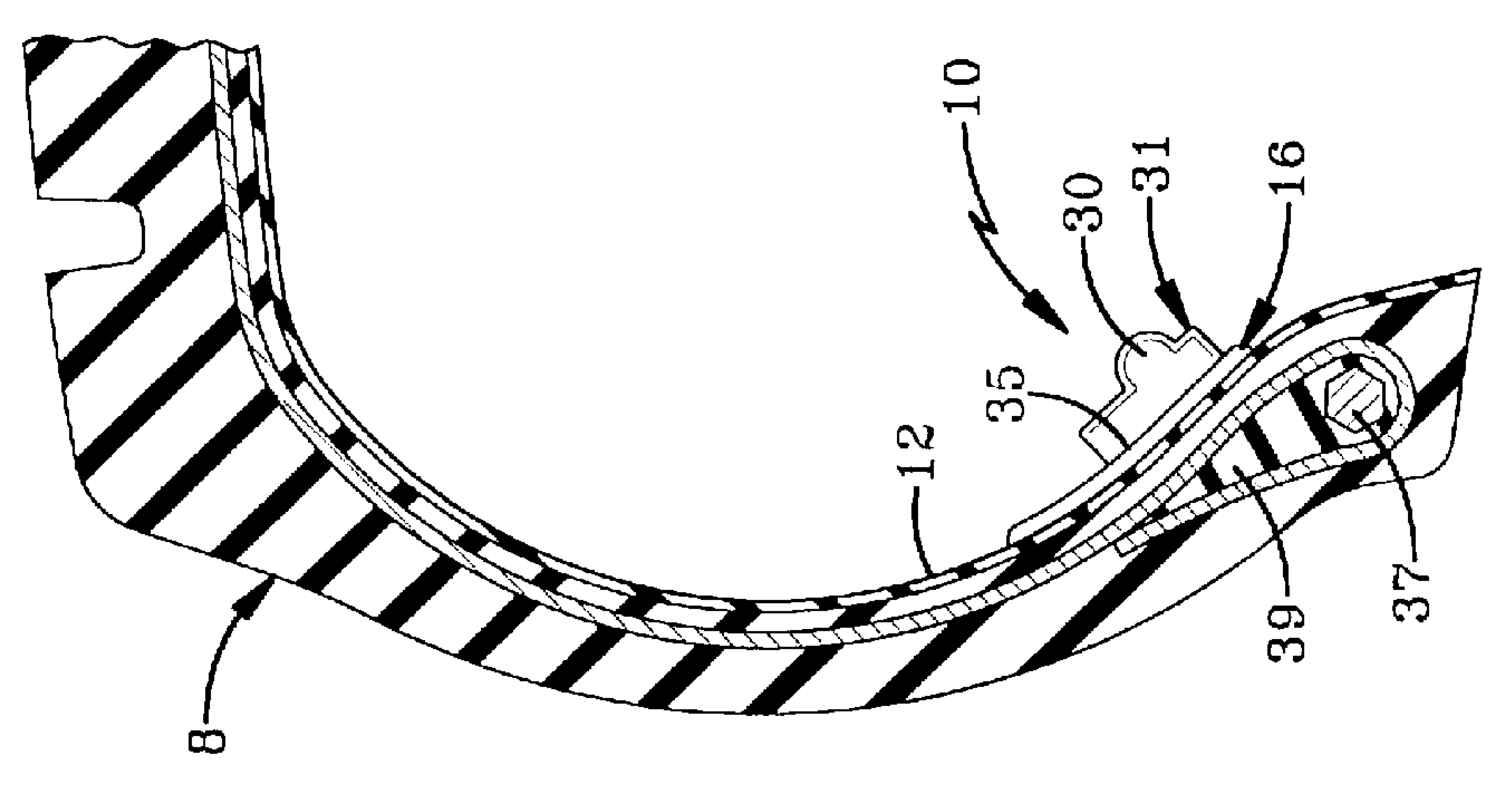
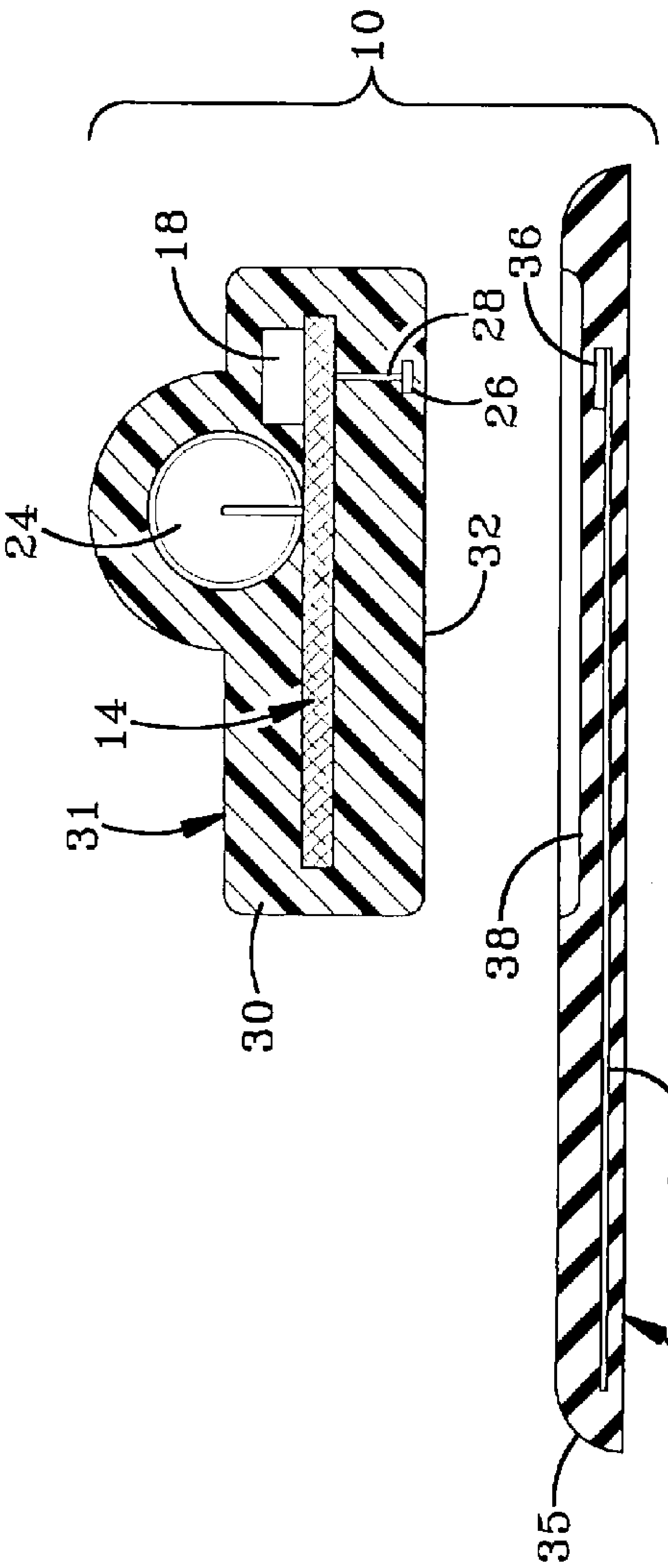
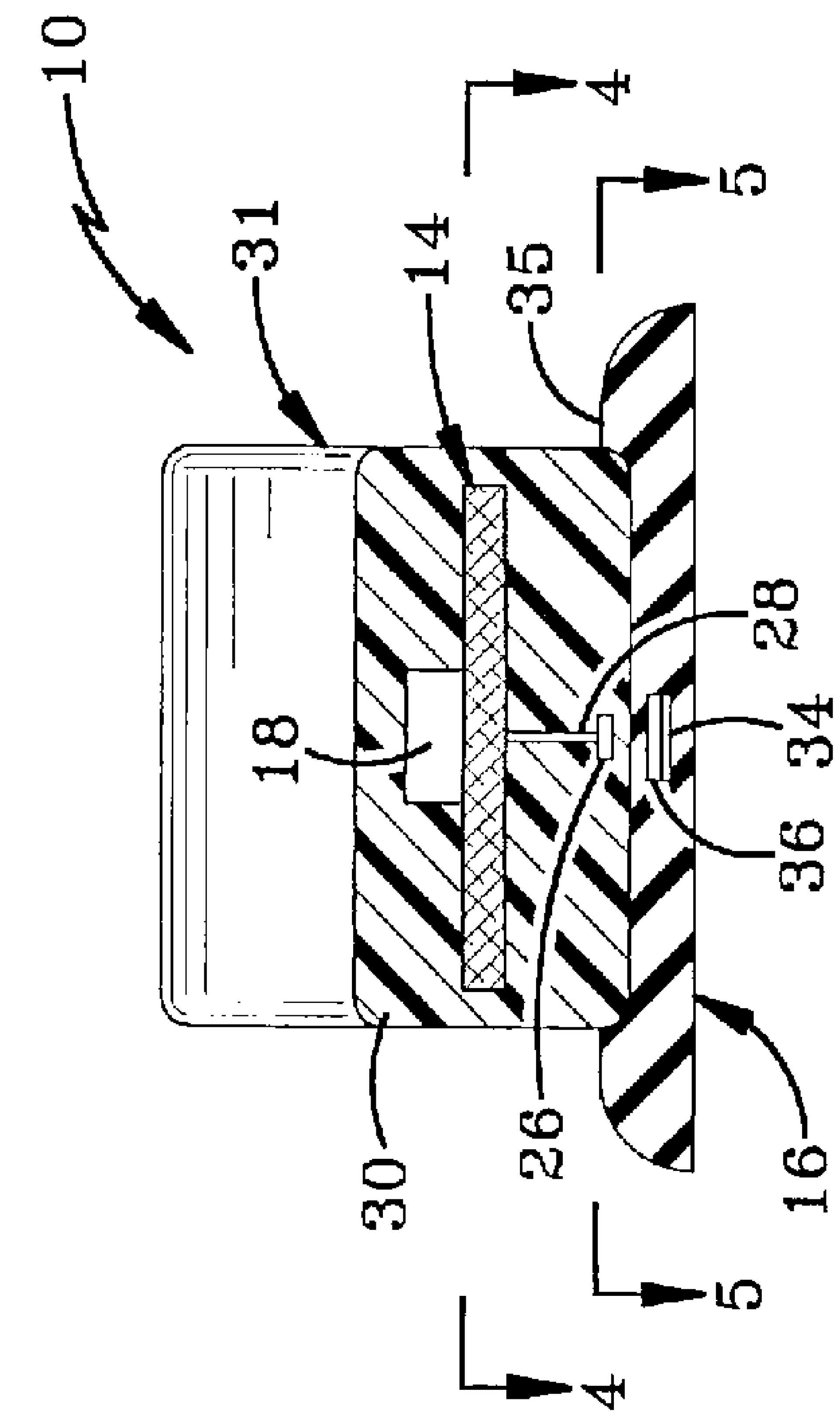


FIG—1



FIG—2



FIG—3

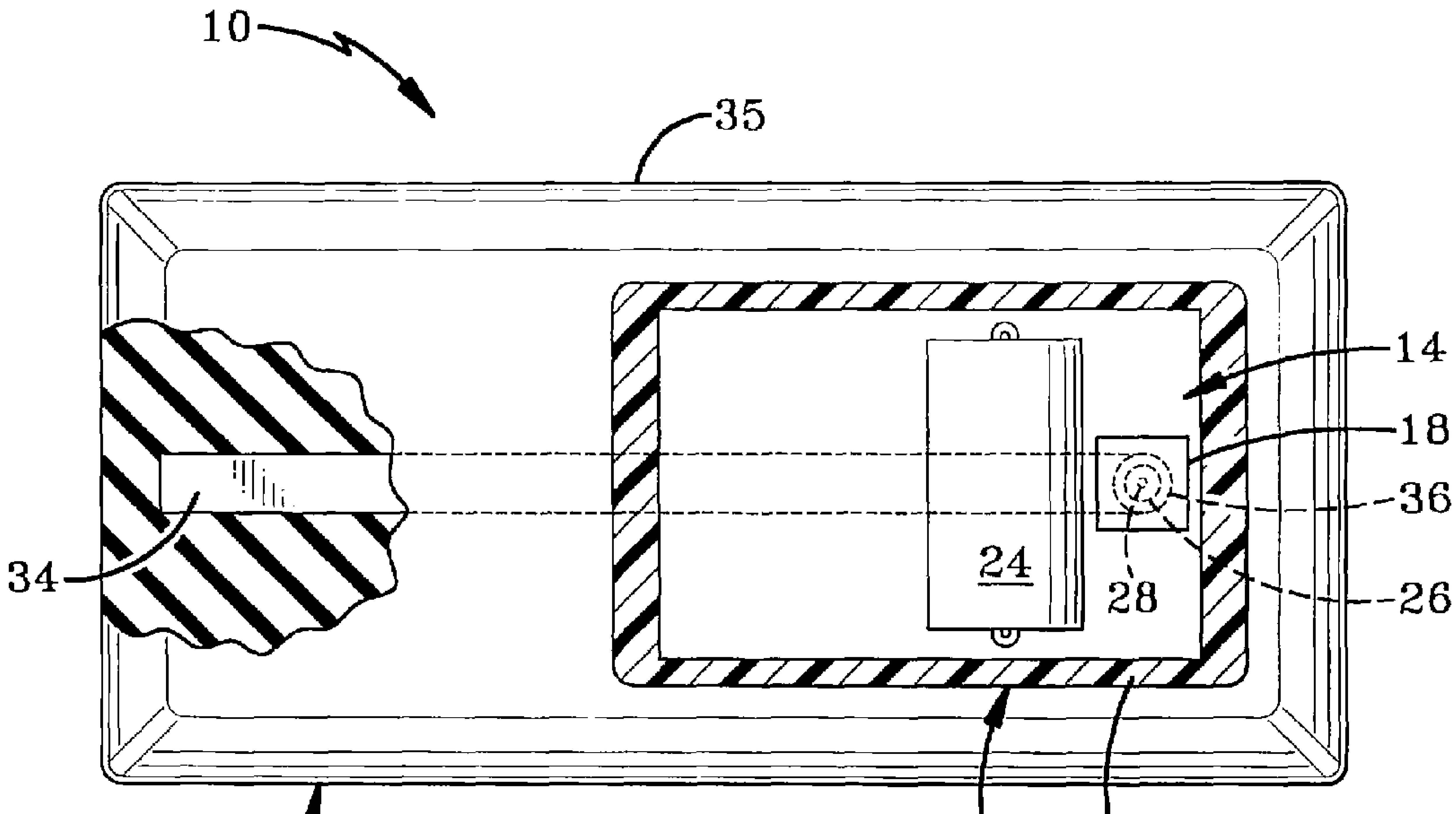


FIG-4

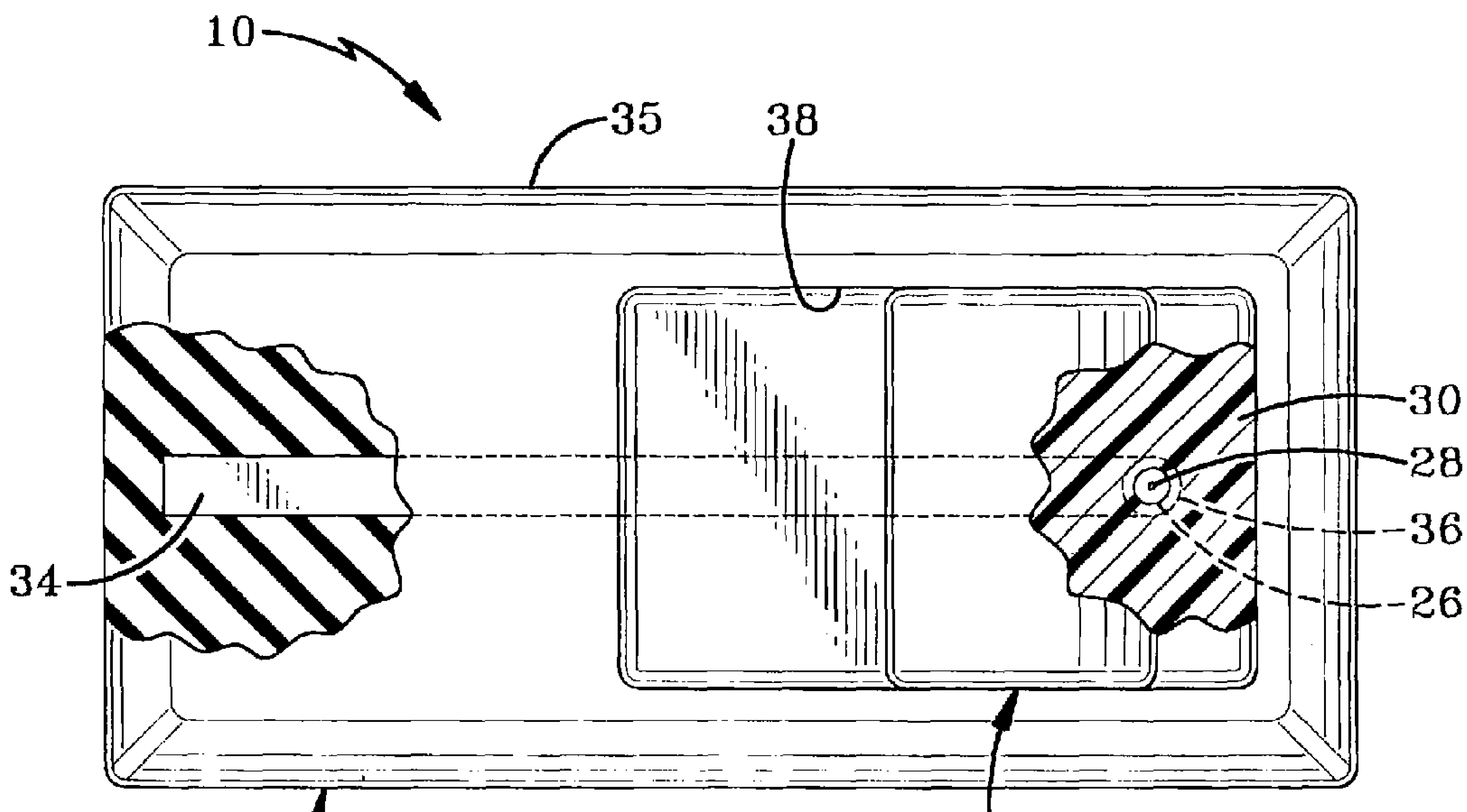
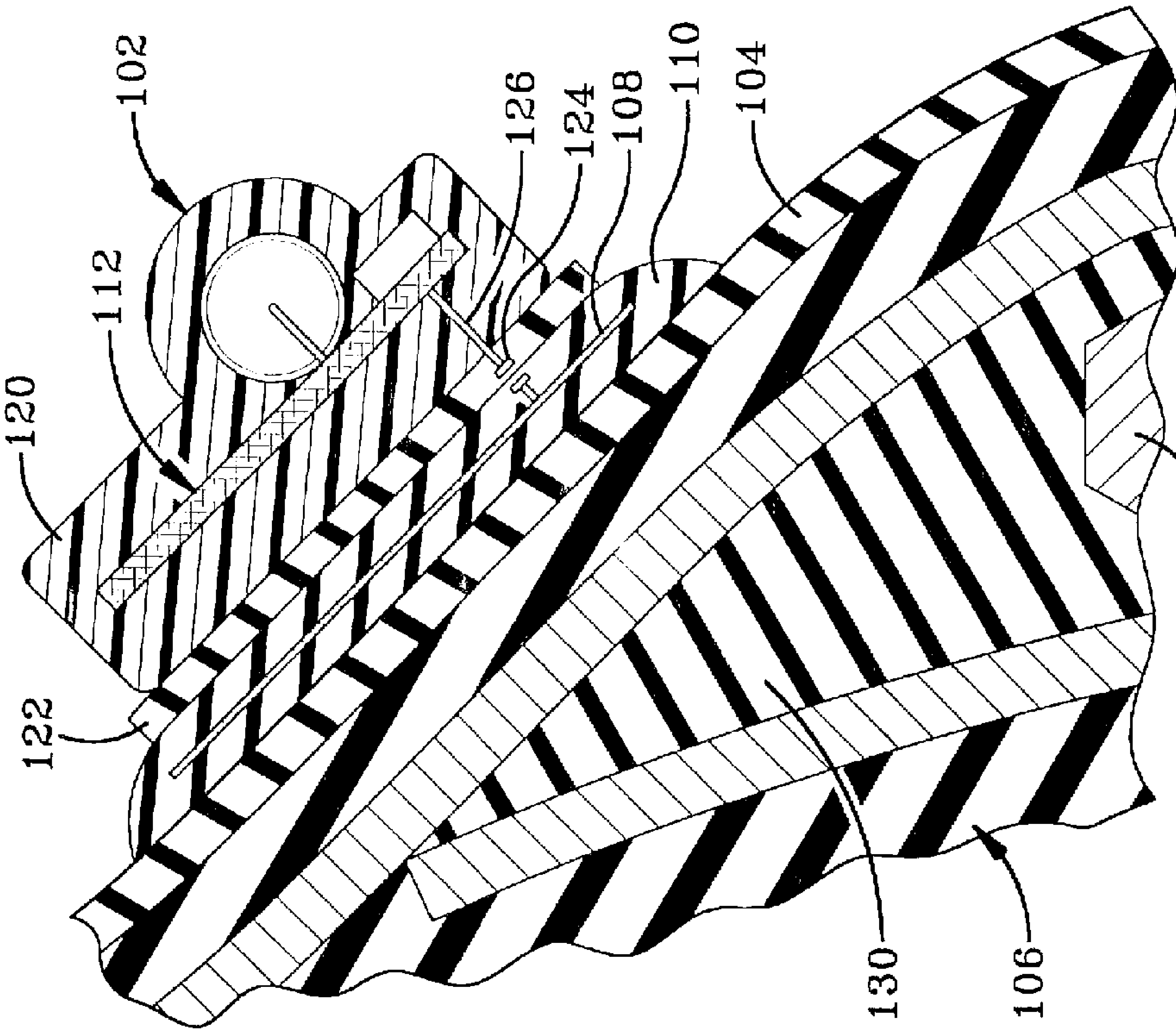


FIG-5

FIG—7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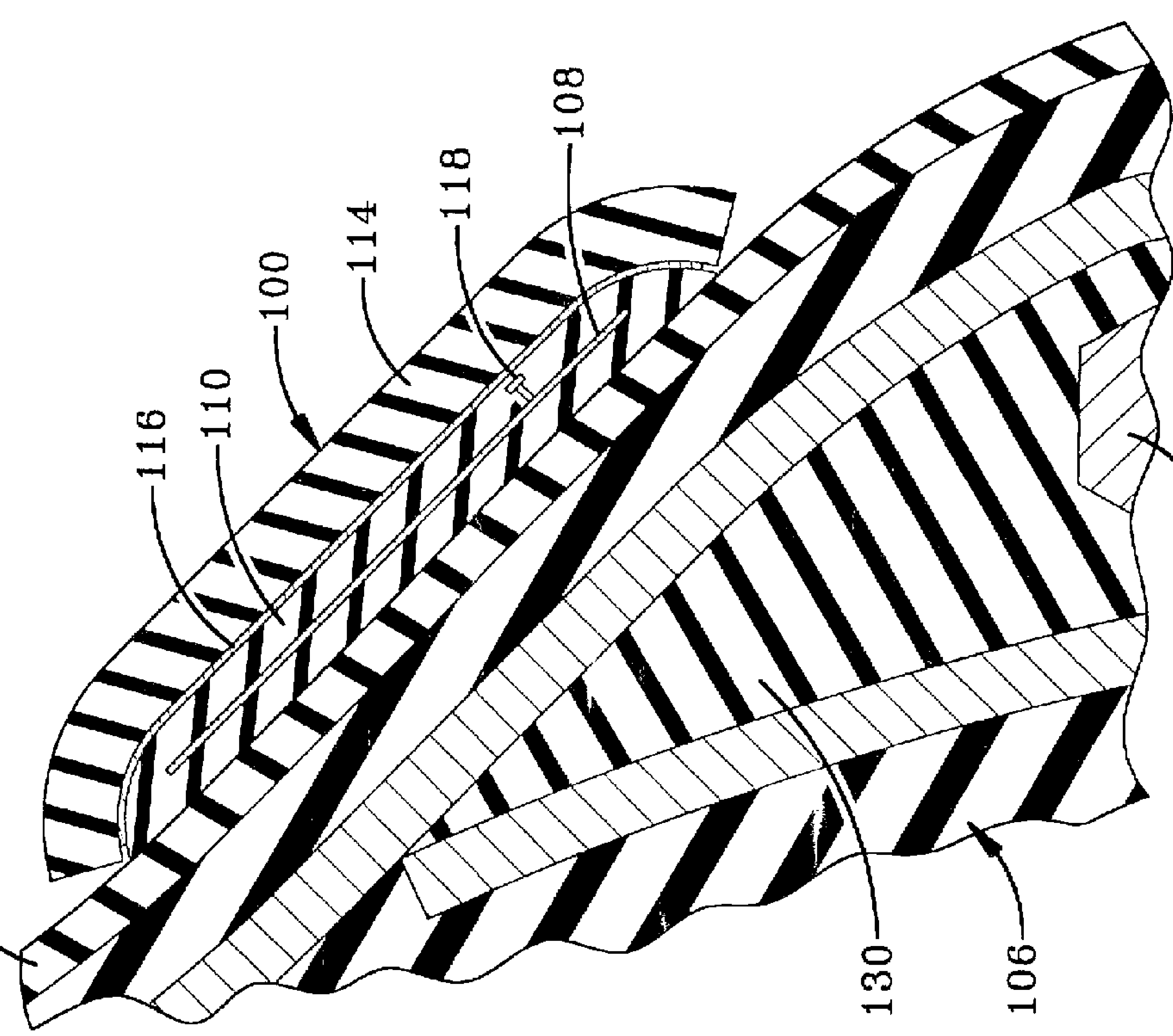
126
124
108
110
104
112
120
122
128
130
106

FIG—6


104
116
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114
118
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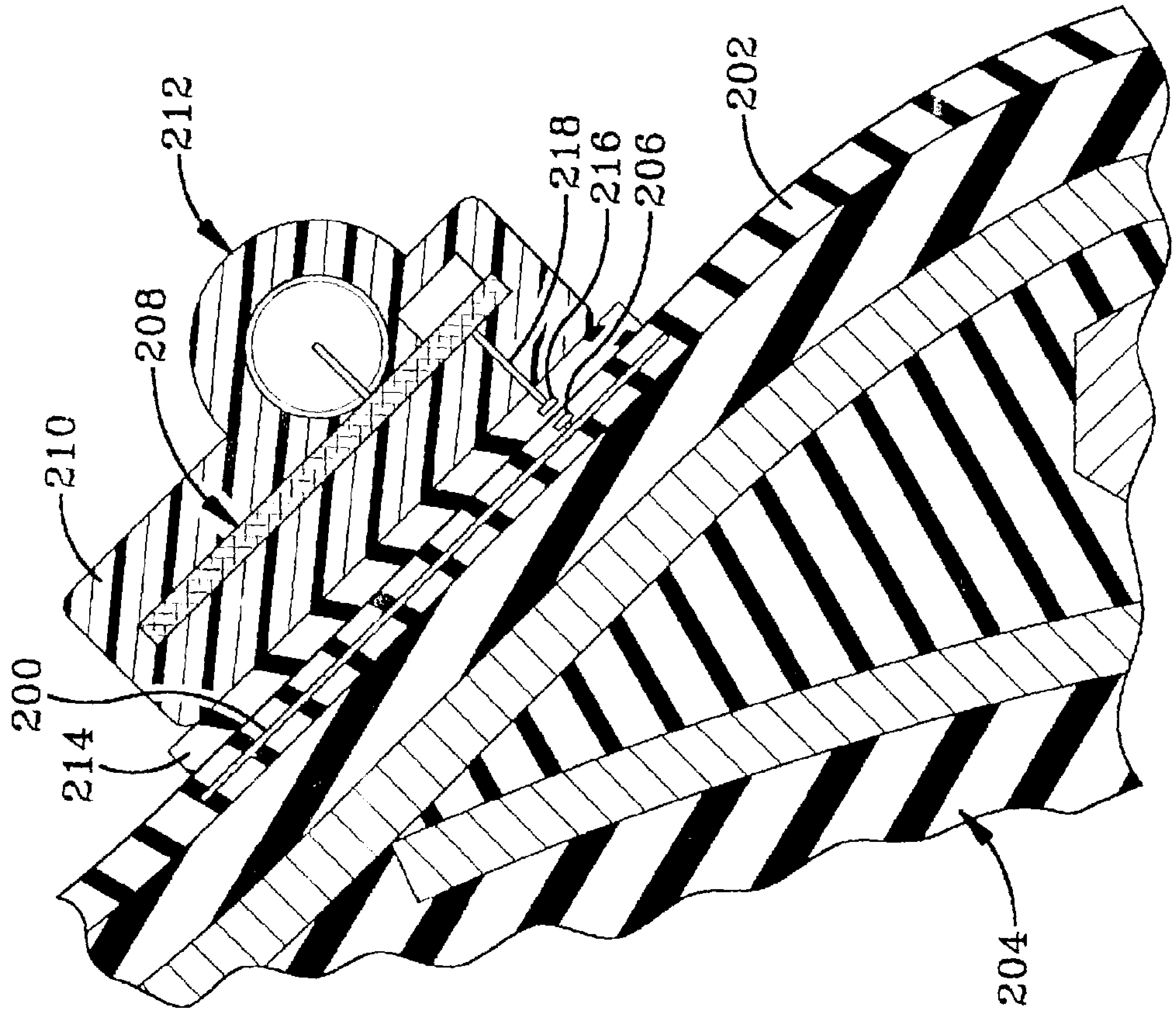
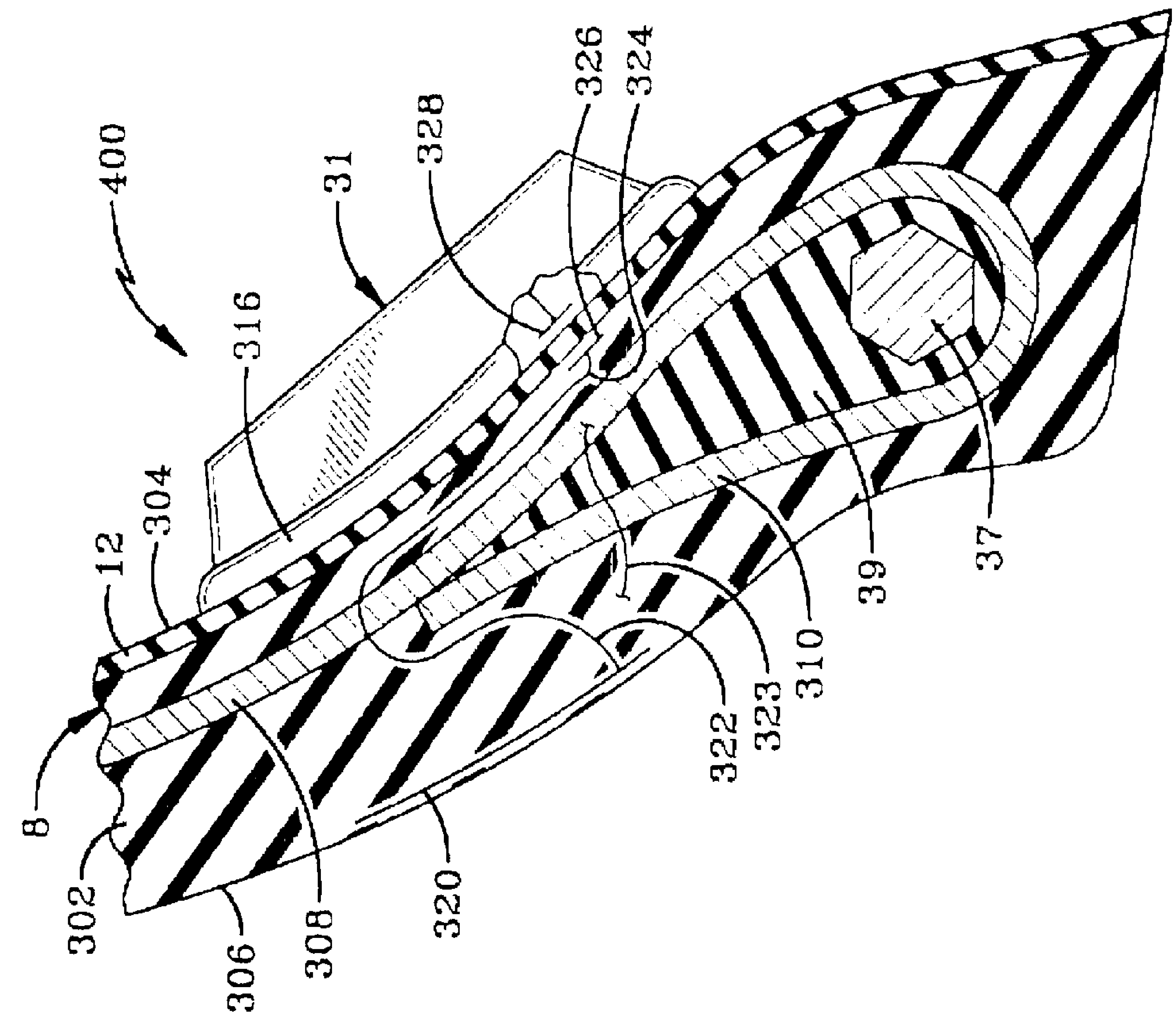
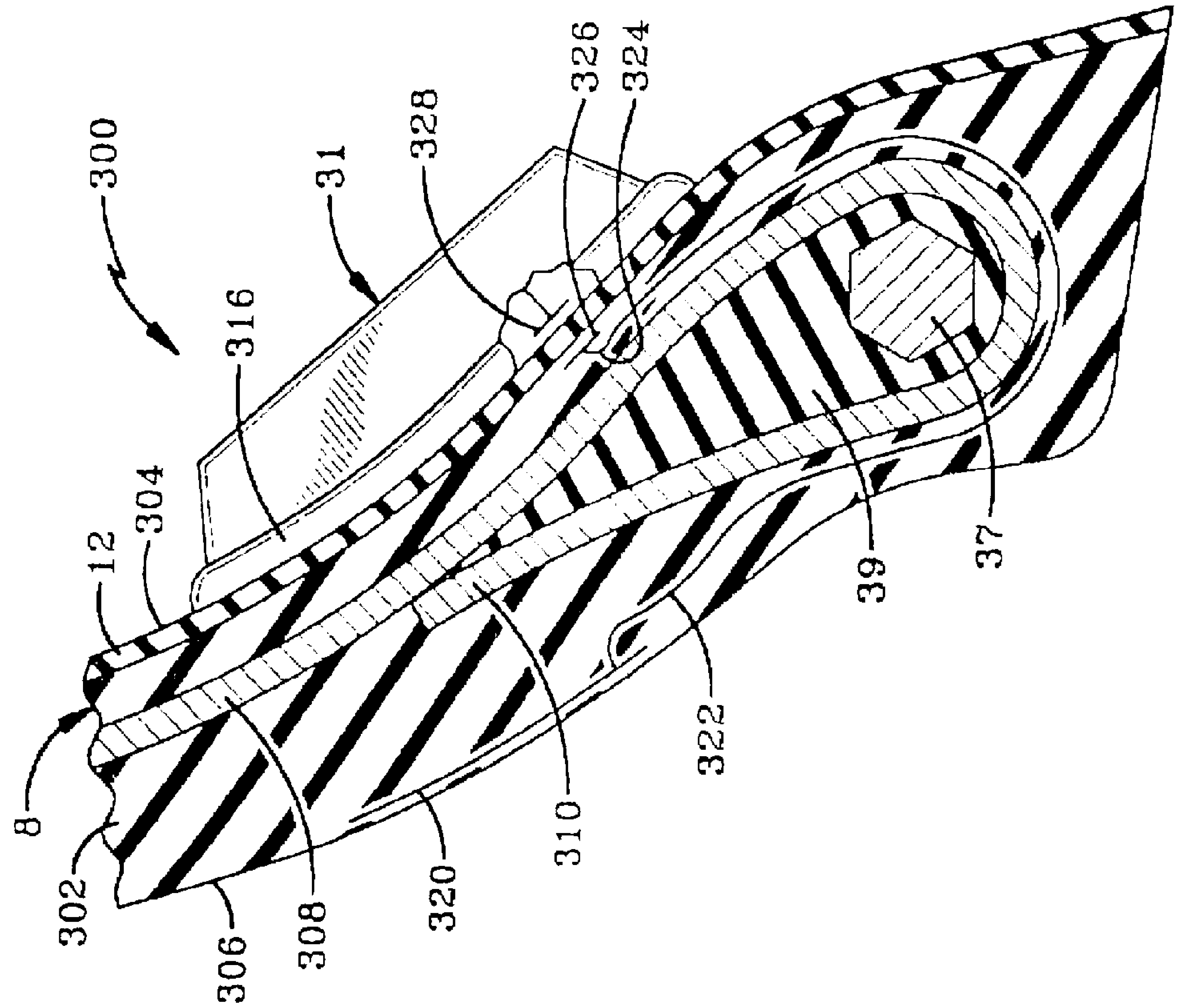
128
130
106

FIG—8

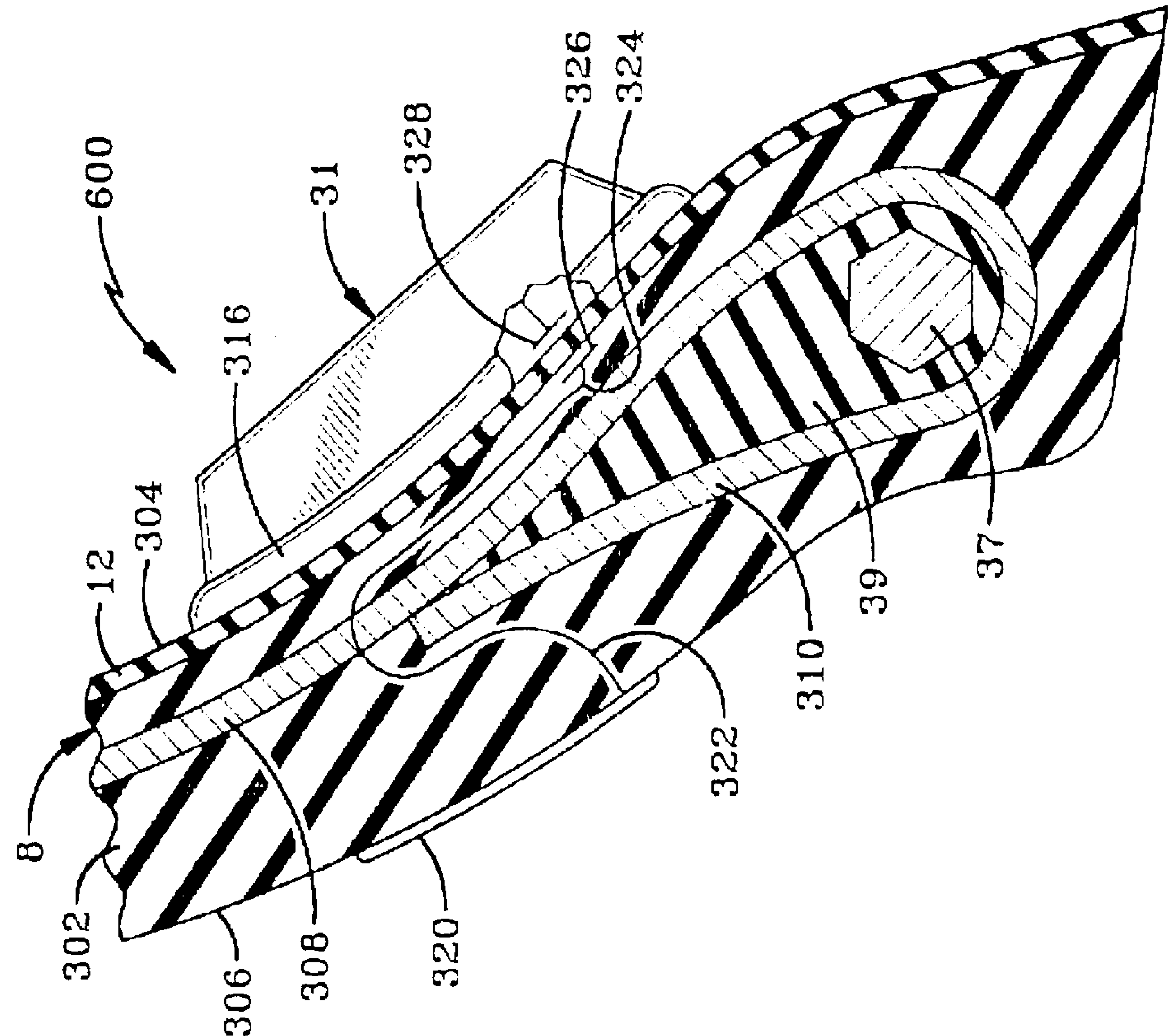



400
31
328
326
324
316
304
12
8
302
306
308
320
322
323
310
39
37

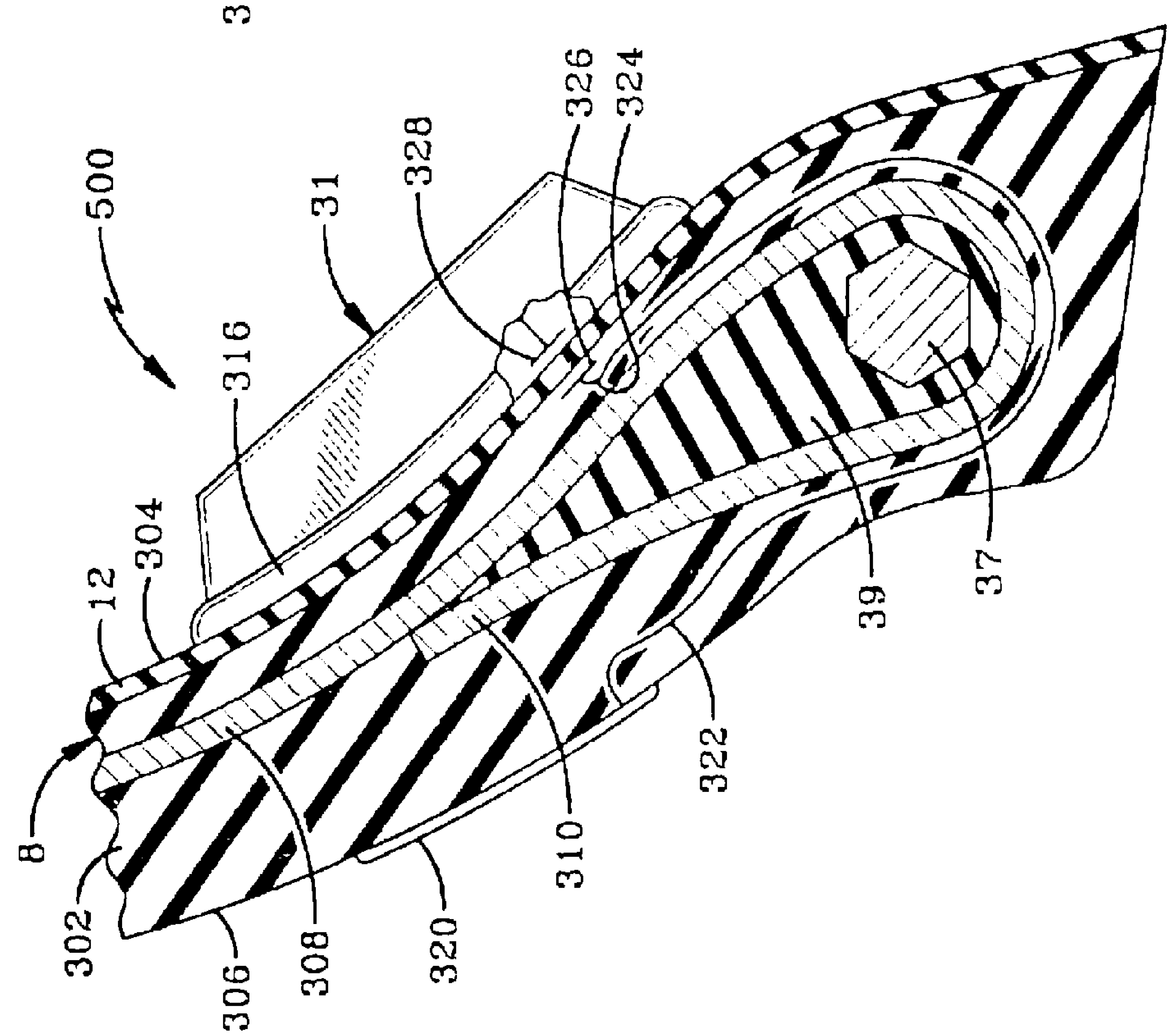
FIG—10


300
31
328
326
324
316
304
12
8
302
306
308
320
310
322
39
37

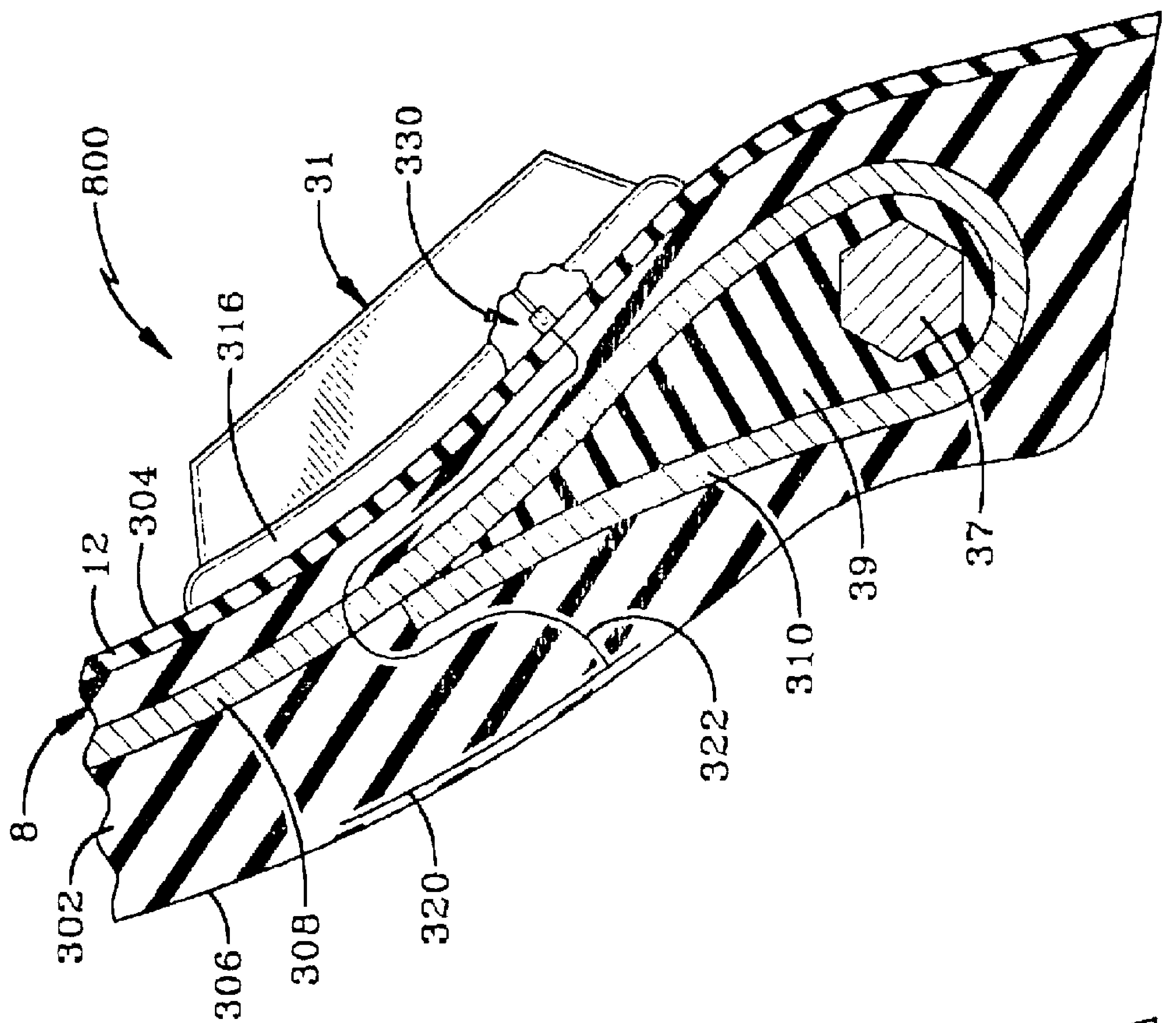
FIG—9


600
31
316
328
326
324
12
304
8
302
306
308
320
322
310
39
37

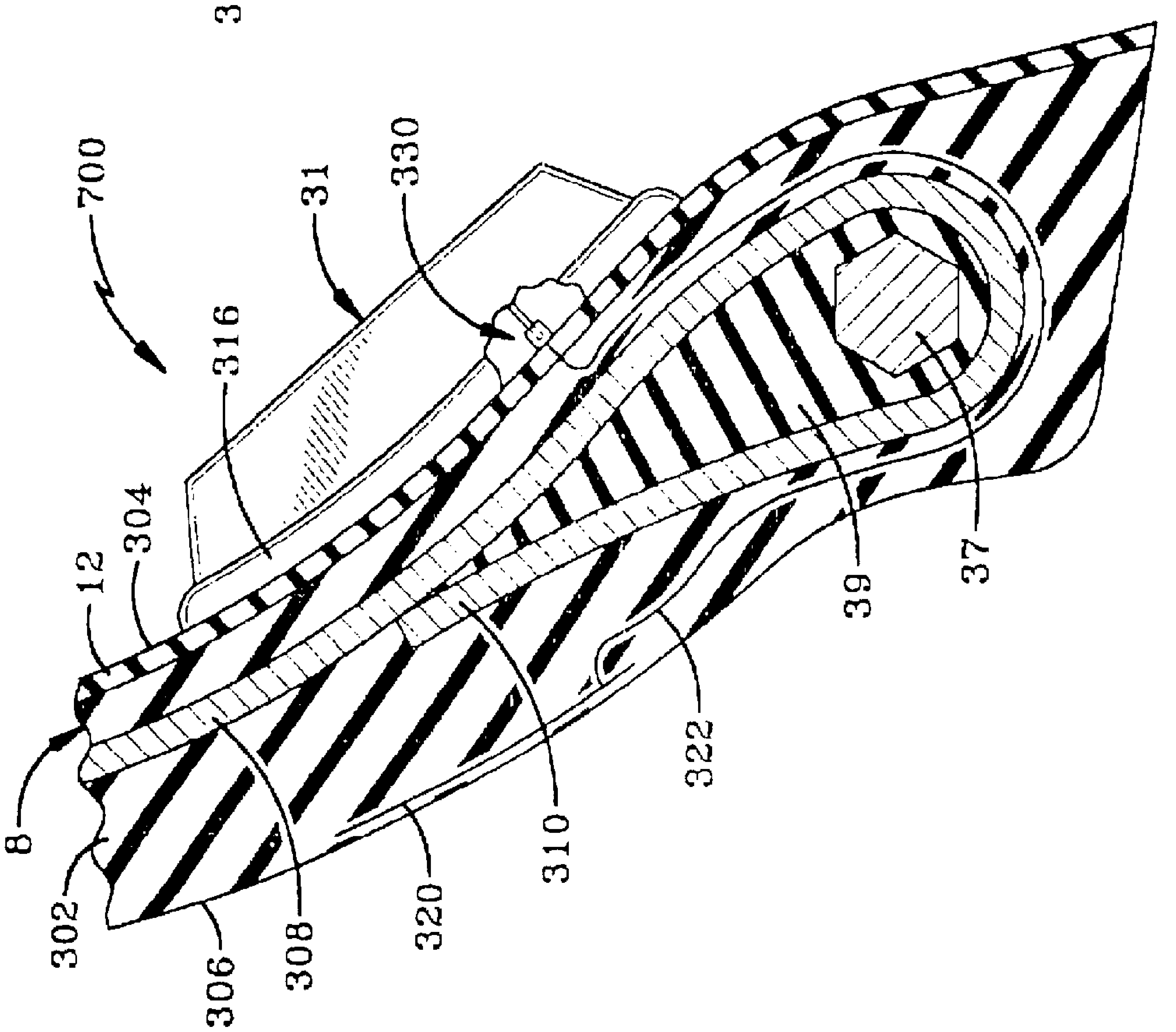
FIG—12


500
31
316
328
326
324
12
304
8
302
306
308
320
310
322
39
37

FIG—11


800
31
330
316
304
12
8
302
306
308
320
322
310
39
37

FIG—14


700
31
330
316
304
12
8
302
306
308
320
310
322
39
37

FIG—13

TIRE WITH MONITORING DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation application claiming priority to U.S. patent application Ser. No. 11/593,687 filed Nov. 7, 2006 now U.S. Pat. No. 7,592,902, which is a continuation application Ser. No. 11/155,233 filed Jun. 17, 2005 claiming priority from U.S. Pat. No. 7,132,930 which is a continuation of application Ser. No. 09/793,253, filed Feb. 26, 2001, now U.S. Pat. No. 6,919,799, which is a continuation-in-part of application Ser. No. 09/301,793, filed Apr. 29, 1999, now U.S. Pat. No. 6,208,244; the disclosures of each are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention generally relates to the combination of a monitoring device and a pneumatic tire. More particularly, the present invention relates to a pneumatic tire and monitoring device combination wherein the antenna for the monitoring device is spaced from the monitoring device. Specifically, the antenna is mounted outside the body cords and connected to the monitoring device with a connector that is coupled to or directly connected to the monitoring device.

2. Background Information

Various industries and users want to actively monitor at least one engineering condition of a tire while the tire is installed and in use on a vehicle. Typical desirable measurements are internal temperature and pressure. These measurements are preferably gathered without having to remove the tire from the vehicle or specially positioning the tire to gather the data. Numerous types of monitoring devices are known in the art to perform these measurements. One type of monitoring device uses a passive integrated circuit embedded within the body of the tire that is activated by a radio frequency transmission that energizes the circuit by inductive magnetic coupling. Other prior art devices used for monitoring tire conditions include self-powered circuits that are positioned external of the tire, such as at the valve stem. Other active self-powered programmable electronic devices are disclosed in U.S. Pat. Nos. 5,573,610, 5,562,787, and 5,573,611 which are assigned to the assignee of the present application.

Each of the active self-powered programmable electronic devices includes an antenna that is used to transmit the data created by the monitoring device to the data gathering device positioned outside of the tire. One of the problems in the art is to position the antenna such that the data created by the monitoring device is accurately transmitted to the data gathering device outside of the tire. It is desired to position the antenna as close to the outside of the pneumatic tire as possible so that the transmissions pass through as little of the tire as possible. In the past, the antenna of the monitoring device generally extended into the interior chamber of the tire such that the radio waves had to pass first through the air inside the tire, through the innerliner, through the tire sidewall, and then through the air to the data gathering device. It is desired in the art to provide an antenna for an active, self-powered programmable electronic device that is positioned so that the radio waves do not have to first pass through the inner chamber of the tire before entering the tire sidewall. The bead ring and apex filler of the tire tend to block the radio transmission from the monitoring device. It is thus desired in the art to position the antenna away from the bead ring and apex filler so that the transmission through the tire sidewall is as strong as possible.

On the other hand, it is also desirable to position the monitoring device as close to the bead ring as possible because that area of the tire sidewall experiences fewer forces and stretching than the middle portion of the tire sidewall. It is thus desired in the art to provide a method for attaching the antenna to the monitoring device that accommodates the ideal position for both elements.

The monitoring devices known in the art are typically encapsulated with an encapsulation material that provides structural support to the monitoring device so that the device is not destroyed by the forces normally encountered and experienced by a pneumatic tire. In some applications, the process of encapsulation will take into account that the antenna must extend from the encapsulated monitoring device. It is desired to provide a monitoring device configuration that eliminates this encapsulation problem by positioning the antenna apart from the monitoring device.

One method of connecting the monitoring device to the innerliner of a tire includes the use of a rubber attachment patch to carry the monitoring device with the inner surface of the rubber patch being configured to securely adhere to the innerliner of a tire. It is desired that the sensitive electronic monitoring device and the rubber patch be capable of being manufactured in separate locations and assembled when the monitoring device is attached to the innerliner of a tire. Separating the rubber attachment patch and the sensitive monitoring device also allows the rubber attachment patch to be aggressively attached to the innerliner of a tire without the risk of damaging the sensitive monitoring device. After the rubber attachment patch is securely anchored to the innerliner, the monitoring device may be attached to the patch.

SUMMARY OF THE INVENTION

The invention provides a monitoring device and tire combination wherein an antenna is mounted to the tire in a location spaced from the monitoring device. In one embodiment, the antenna may be mounted to the tire sidewall outside the body cords of the tire. The antenna may be mounted on the outer surface of the sidewall or embedded within the body of the sidewall. The antenna is connected to the monitoring device with a connector. The connector may be electrically coupled to the monitoring device or may be connected to the monitoring device with a plug and socket connection. When the antenna is outside the body cord, the connector may extend from the antenna through the bead filler, over the top of the turn up, or under the bead ring.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial sectional view of a pneumatic tire with the monitoring device and patch combination connected to the innerliner of the pneumatic tire.

FIG. **2** is a sectional side view of the monitoring device and patch combination of the present invention.

FIG. **3** is a sectional end view of the monitoring device and patch combination showing the alignment of the first electrical pad with the second electrical pad.

FIG. **4** is a sectional view taken along line **4-4**, FIG. **3**.

FIG. **5** is a fragmentary sectional view taken along line **5-5**, FIG. **3** showing a portion of the encapsulated monitoring device in section and a portion of the patch in section.

FIG. **6** is a sectional view similar to FIG. **1** showing an alternative embodiment of the present invention.

FIG. **7** is a sectional view similar to FIG. **6** showing the attachment of the monitoring device to the innerliner of a tire with the first alternative embodiment of the present invention.

FIG. **8** is a sectional view similar to FIGS. **6** and **7** showing a second alternative embodiment of the present invention.

FIG. **9** is a sectional view of the tire sidewall depicting a third alternative embodiment of the invention.

FIG. **10** is a sectional view of the tire sidewall depicting a fourth alternative embodiment of the invention.

FIG. **11** is a sectional view of the tire sidewall depicting a fifth alternative embodiment of the invention.

FIG. **12** is a sectional view of the tire sidewall depicting a sixth alternative embodiment of the invention.

FIG. **13** is a sectional view of the tire sidewall depicting a seventh alternative embodiment of the invention.

FIG. **14** is a sectional view of the tire sidewall depicting an eighth alternative embodiment of the invention.

Similar numerals refer to similar parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The first embodiment of the monitoring device and patch combination of the present invention is depicted in FIGS. **1-5** and is indicated generally by the numeral **10**. Combination **10** is connected to an innerliner **12** of a pneumatic tire **8** as shown in FIG. **1**. Combination **10** preferably is connected to innerliner **12** by an attachment that is known in the art, such as a suitable adhesive.

Combination **10** includes a monitoring device **14** and an attachment patch **16** that are fabricated separately. Monitoring device **14** includes at least one sensing element **18** that is configured and adapted to read at least one desired parameter or sense at least one desired engineering condition of pneumatic tire **8**. Monitoring device **14** further includes a power source or battery **24** that supplies power to monitoring device **14**. In addition to the devices discussed above, other examples of monitoring devices are shown in U.S. Pat. No. 5,573,610, the contents of which are incorporated herein by reference. Sensing element **18** is connected to a first electrical pad **26** by a suitable connector **28** such as a wire. Electrical pad **26** may be spaced from monitoring device **14** or may be an integral element of monitoring device **14**.

Monitoring device **14** and first electrical pad **26** are preferably encapsulated by an encapsulation material **30** that serves to protect monitoring device **14**. Encapsulation material **30** may be a suitable epoxy or plastic that provides a rigid structure around monitoring device **14** and electrical pad **26**. Encapsulation material **30** forms an encapsulated monitoring device **31** that includes a bottom surface **32** that provides a mounting surface for encapsulated monitoring device **31**. Bottom surface **32** has at least one portion that is substantially planar. First electrical pad **26** is substantially parallel to the planar portion of bottom surface **32** and is also adjacent to bottom surface **32**, but is still completely surrounded by encapsulation material **30**.

Patch **16** includes an antenna **34** embedded within the body of the patch. A second electrical pad **36** is connected to antenna **34** and is also embedded within patch **16**. Patch **16** may be formed from a suitable rubber or combination of rubbers that are compatible with and provide desirable adhesion properties with innerliner **12**. Patch **16** has a top surface **38** sized and adapted to receive encapsulated monitoring device **31** such that bottom surface **32** lies against top surface **38** when encapsulated monitoring device **31** is connected to patch **16**. Second electrical pad **36** is adjacent to top surface **38** but spaced therefrom by the material of patch **16**. Second electrical pad **36** may be integrally formed with antenna **34** and, in some embodiments of the invention, may simply be a portion of antenna **34** disposed where it may electrically couple through the material of patch **16**. Antenna **34** may be any of a variety of suitable antennas such as a wire, a bar, a plate, or the like.

In accordance with one of the objectives of the present invention, patch **16** includes a foot portion **35** that extends away from top surface **38**. Antenna **34** is embedded within foot portion **35** such that it is positioned away from encapsulated monitoring device **31**. Foot portion **35** of patch **16** allows encapsulated monitoring device **31** to be positioned closer to the bead ring **37** and apex filler **39** of tire **8** than antenna **34**. Such positioning allows the signals from antenna **34** to propagate around bead ring **37** and apex filler **39**.

In accordance with another of the objectives of the present invention, first electrical pad **26** is aligned with second electrical pad **36** when encapsulated monitoring device **31** is mounted on patch **16**. Although first and second electrical pads **26** and **36** are aligned, they remain spaced from each other by the intervening material of patch **16** and encapsulation material **30**. Electrical pads **26** and **36** are close enough, however, to create an electrical coupling such that sensing element **18** is in communication with antenna **34**. Such electrical coupling is known to those skilled in the art and allows a signal to be communicated between pads **26** and **36**. Such alignment and spacing is in accordance with another objective of the present invention that allows encapsulated monitoring device **31** to be installed on patch **16** without requiring a direct physical electrical connection between antenna **34** and monitoring device **14**.

Monitoring device **14** and patch **16** may be connected to innerliner **12** in the following manner. First, monitoring device **14** is provided with sensing element **18**, first electrical pad **26**, and connector **28**. Monitoring device **14** is then encapsulated with encapsulation material **30** to entirely encapsulate monitoring device **14** and first electrical pad **26**. Patch **16** is then fabricated with antenna **34** embedded within the body of patch **16**. Antenna **34** is connected to second electrical pad **36** that is also embedded within the body of patch **16**. The steps of fabricating device **31** and patch **16** may be performed at separate locations because no physical connection between antenna **34** and device **31** is required.

Pneumatic tire **8** is then selected having innerliner **12** where combination **10** is installed. Encapsulated monitoring device **31** first may be connected to patch **16** by aligning first electrical pad **26** with second electrical pad **36**. Encapsulated monitoring device **31** is then connected to patch **16** by seating bottom surface **32** of encapsulated monitoring device **31** onto top surface **38** of patch **16**. A suitable manner of connecting the two elements is used such as a suitable adhesive.

Device **31** and patch **16** are then connected to innerliner **12** by a suitable connector such as an adhesive. The connection of combination **10** to innerliner **12** thus does not require a direct physical electrical connection between antenna **34** and monitoring device **14**. The alignment of electrical pads **26** and **36** and the resulting electrical coupling provides the necessary communication between antenna **34** and monitoring device **14**.

Combination **10** may also be installed on pneumatic tire **8** by first connecting patch **16** to innerliner **12**. Patch **16** may be aggressively stitched to innerliner **12** without the danger of damaging monitoring device **14** because monitoring device **14** is later connected to patch **16**. After patch **16** is suitably connected to innerliner **12**, monitoring device **14** is aligned with patch **16** as discussed above and connected by a suitable connector such as an adhesive. The communication between antenna **34** and monitoring device **14** is automatically created when electrical pads **26** and **36** are properly aligned, namely signal coupling is achieved between the antenna and monitoring device without any physical electrical connection therebetween.

A first alternative embodiment of the invention is depicted in FIGS. **6** and **7**. In the first alternative embodiment, an anchoring patch **100** is used to connect the encapsulated monitoring device **102** to the innerliner **104** of a tire **106**. In accordance with one of the objectives of the present invention, an antenna **108** is embedded within an anchoring layer **110** of anchoring patch **100**. Communication is provided between antenna **108** and a monitoring device **112** when monitoring device **112** is attached to anchoring layer **110**. The communication is provided through electrical coupling.

Anchoring patch **100** includes a cover **114** formed from any of a variety of cured rubbers that is separated from anchoring layer **110** by a layer of cure material **116** such as cure paper or cure cloth. Anchoring layer **110** is fabricated from an uncured rubber that may be a dual cure rubber or a rubber cured either by heat or by a chemical reaction. Examples of anchoring patch **100** and methods for using the patch are taught in U.S. patent application Ser. Nos. 09/206,273 and 09/205,931, filed Dec. 4, 1998. Antenna **108** is connected to an electrical pad **118** that helps provide the electrical coupling between antenna **108** and monitoring device **112**. Electrical pad **118** may be an integral part of antenna **108**, an extension of antenna **108**, or a separate element that is connected to antenna **108**. Electrical pad **118** may be positioned adjacent the outer surface of anchoring layer **110**.

Encapsulated monitoring device **102** includes monitoring device **112** surrounded by an encapsulation material **120**. Encapsulated monitoring device **102** is mounted on an attachment patch **122** that is used to mount encapsulated monitoring device **102** on tire **106**. Another electrical pad **124** is disposed in attachment patch **122** and is directly connected to monitoring device **112** by a suitable connector **126**. In other embodiments of the invention, the connection between electrical pad **124** and monitoring device **112** is formed by electrical coupling as described above.

As shown in the drawings, the position of antenna **108** may be located away from bead ring **128** and apex filler **130** while allowing monitoring device **112** to be disposed closer to bead ring **128**. The length and configuration of antenna **108** is not limited by the overall size of encapsulated monitoring device **102** or attachment pad **122** and may be configured to provide reliable communication with the data-gathering device positioned outside tire **106**.

Monitoring device **112** may be mounted on tire **106** in the following manner. First, anchoring patch **100** is adhered to innerliner **104** by a suitable adhesive or by curing anchoring patch **100** to innerliner **104**. This cure may be a chemical cure or a heat cure performed during the curing of the green tire. After anchoring patch **100** has been cured, cover **114** and cure material **116** are removed to allow attachment patch **122** carrying encapsulated monitoring device **102** to be directly adhered to anchoring layer **110**. Attachment patch **122** may be adhered to anchoring layer **110** by a suitable adhesive or by providing a layer of uncured rubber such as a cushion gum or dual cure rubber on the outer surface of attachment patch **122** which is then cured to anchoring layer **110**.

Encapsulated monitoring device **102** is first positioned such that electrical pads **118** and **124** are aligned. Encapsulated monitoring device **102** and attachment patch **122** are then attached to anchoring layer **110**. Electrical pads **118** and **124** remain aligned but spaced such that they provide electrical coupling between antenna **108** and electronic monitoring device **112**.

A second alternative embodiment of the present invention is depicted in FIG. **8**. In the second alternative embodiment, the antenna **200** is embedded within the innerliner **202** of the tire **204**. Antenna **200** is embedded within innerliner **202** during the manufacture of innerliner **202** and may be ideally configured to communicate with a data gathering device (not shown) that is positioned outside of tire **204**. An electrical pad **206** is connected to antenna **200** and provides communication between antenna **200** and an electronic monitoring device **208**. Electrical pad **206** may be an integral part of antenna **200** and simply may be a portion of antenna **200** that is disposed in the correct position to function as electrical pad **206**.

Electronic monitoring device **208** is encapsulated with an encapsulation material **210** to form encapsulated monitoring device **212**. Encapsulated monitoring device **212** is mounted on attachment patch **214**. Another electrical pad **216** is embedded within attachment patch **214** and directly connected to electronic monitoring device **208** by a suitable connector **218**. The connection between electrical pad **216** and electronic monitoring device **208** may be the direct connection depicted in FIG. **8** or may be formed by electrical coupling as described above with respect to FIGS. **1-5**.

Encapsulated monitoring device **212** is attached to attachment patch **214** by suitable means such as an adhesive. Attachment patch **214** is connected to innerliner **202** by suitable means such as an adhesive. Communication between antenna **200** and electronic monitoring device **208** is provided by aligning electrical pads **206** and **216** and then connecting attachment patch **214** to innerliner **202**. Electrical pads **206** and **216** are aligned but spaced to provide electrical coupling through the material of innerliner **202** and attachment patch **214**. The electrical coupling provides communication between antenna **200** and electronic monitoring device **208**.

A third alternative embodiment of the present invention is indicated generally by the numeral **300** in FIG. **9**. Combination **300** includes monitoring device **31** and pneumatic tire **8**. Monitoring device **31** may be encapsulated as described above but monitoring device **31** may also be protected in other manners or not protected at all. As described above, pneumatic tire **8** includes an innerliner **12** that defines the inner surface of a sidewall **302** of tire **8**. Sidewall **302** thus includes an inner surface **304** and an outer surface **306**. At least one body cord **308** is disposed in sidewall **302**. Body cord **308** includes a turn up portion **310** that wraps around bead ring **37** and apex filler or bead filler **39**. In some embodiments of tire **8**, turn up **310** lays back against body cord **308**. In other embodiments of the invention, tire **8** may include a turn up **310** that does not extend entirely back against body cord **308**. In other embodiments of the invention, tire **8** may include multiple body cords having turn up portions extending at different heights.

In combination **300**, monitoring device **31** is connected to inner surface **304** of sidewall **302** with a patch **316** that is formed from suitable rubber or combinations of rubber and other materials that are compatible with and provide desirable adhesion properties with innerliner **12** and monitoring device **31**. In other embodiments of the invention, encapsulated monitoring device **31** is connected directly to inner surface **304** and patch **316** is not required. In other embodiments, monitoring device **31** may be embedded in sidewall **302**.

Combination **300** includes an antenna **320** mounted to tire **8** in a location spaced from encapsulated monitoring device **31**. Antenna **320** communicates with monitoring device **31** through a connector **322**. Antenna **320** may be any of a variety of antennas known in the art. For instance, antenna **320** may be a wire, an elongated plate, a coil, or other antenna structures known to those skilled in the art. Antenna **320** may be a monopole antenna or a dipole antenna. Connector **322** may be an electrically conductive material such as a metal wire, a plurality of wires, or a section of conductive polymer disposed within sidewall **302**.

The inner end **324** of connector **322** may be connected to monitoring device **31** with a direct connection that is substantially permanent or a removable, reattachable connection such as a plug and socket connection or the coupled connection depicted in FIG. **9**. The outer end of connector **322** may be connected to antenna **320** with any of these connection configurations. In the coupled connection, a first coupling element **326** is spaced from a second coupling element **328**. First coupling element **326** is connected to connector **322** with second coupling element **328** being connected to monitoring device **31**. Coupling elements **326** and **328** are configured to cooperate with each other to allow electrical communication to pass between the elements. Coupling elements **326** and **328** may be plates, coils, wires, or other structures known to those skilled in the art for creating electrical coupling.

In combination **300**, antenna **320** is embedded within the body of sidewall **302**. Antenna **320** is located outside body cord **308** allowing a larger antenna signal to be transmitted from monitoring device **31** because body cords **308** will not interfere with the signal. Device **31** and antenna **320** may thus operate more effectively and provide for more flexibility in the design of the overall monitoring and reading system. The readers that are located outside of tire **8** may be located in a larger variety of places and still communicate effectively with device **31** because antenna **320** is located outside body cord **308**. In combination **300**, antenna **320** is embedded within sidewall **302**. Antenna **320** may be located closer to outer surface **306** than body cord **308** as depicted in FIG. **9**.

In FIG. **9**, connector **322** extends under bead ring **37**. Connector **322** may thus be substantially parallel to, or follow the general path of, body cord **308** and turn up **310**. A portion of connector **322** will thus be disposed between the vehicle rim and bead ring **37** when tire **8** is mounted to the rim. Connector **322** is preferably embedded within the body of sidewall **302** to protect the integrity of connector **322**. In other embodiments, connector **322** may be disposed along outer surface **306**.

The fourth embodiment of the invention is indicated generally by the numeral **400** in FIG. **10**. Combination **400** is similar to combination **300** except that connector **322** extends over turn up **310**. Connector **322** thus passes beside or through body cord **308**. This configuration protects connector **322** from the friction forces experienced by tire **8** at the interface between tire **8** and the rim. Connector **322** may also extend through bead filler **39** beside both turn up **310** and body cord **308**. This alternative configuration is depicted in FIG. **10** and indicated by the numeral **323**.

The fifth alternative embodiment of the invention is indicated by the numeral **500** in FIG. **11**. Combination **500** includes elements similar to combination **300** described above and the same numbers are used to refer to these elements. In combination **500**, antenna **320** is mounted to outer surface **306** of sidewall **302**. Antenna **320** may be covered by a protective material or may be exposed to the atmosphere surrounding tire **8**. In FIG. **11**, connector **322** extends under bead ring **37**. In FIG. **12**, combination **600** is similar to combination **500** except that connector **322** extends overturn up **310**.

FIGS. **13** and **14** depict combinations **700** and **800** wherein a plug and socket connector **330** is used to connect monitoring device **31** to connector **322**.

In the foregoing description, certain terms have been used for brevity, clearness, and understanding. No unnecessary limitations are to be implied therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes and are intended to be broadly construed.

Moreover, the description and illustration of the invention is an example and the invention is not limited to the exact details shown or described.

The invention claimed is:

1. A tire for a vehicle; the tire comprising:

a sidewall with at least one body cord, a bead ring, a bead filler, and a body cord turn up disposed in the sidewall;

the sidewall having an inner surface and an outer surface;

an electronic device mounted to the inner surface of the sidewall;

an antenna mounted to the tire sidewall in a location spaced from the electronic device;

a connector providing an electrical connection between the antenna and the electronic device; and

a portion of at least one of the body cord, bead filler, and body cord turn up being disposed intermediate the antenna and the electronic device.

2. The tire of claim **1**, wherein the connector passes over the body cord turn up.

3. The tire of claim **1**, wherein the connector extends through the bead filler.

4. The tire of claim **1**, wherein the connector passes under the bead ring.

5. The tire of claim **1**, wherein the antenna is embedded within the sidewall.

6. The tire of claim **1**, wherein the antenna is disposed on the outer surface of the sidewall.

7. The tire of claim **1**, wherein the connector is electrically coupled to the electronic device to provide electrical communication between the antenna and the electronic device.

8. The tire of claim **7**, wherein the connector passes over the body cord turn up.

9. The tire of claim **7**, wherein the connector extends through the bead filler.

10. The tire of claim **7**, wherein the connector passes under the bead ring.

11. The tire of claim **1**, wherein the connector is connected to the electronic device with a detachable plug and socket connection to provide electrical communication between the antenna and the electronic device.

12. The tire of claim **11**, wherein the connector passes over the body cord turn up.

13. The tire of claim **11**, wherein the connector extends through the bead filler.

14. The tire of claim **11**, wherein the connector passes under the bead ring.

15. The tire of claim **1**, further comprising a patch mounted to the inner surface of the sidewall; the electronic device being mounted to the patch.

16. The tire of claim **1**, wherein the antenna is embedded within the tire sidewall.

17. The tire of claim **1**, wherein the antenna is disposed adjacent the outer surface of the sidewall.

18. The tire of claim **1**, wherein portions of at least two of the body cord, bead filler, and body cord turn up being disposed intermediate the antenna and the electronic device.

19. A tire for a vehicle; the tire comprising:

a sidewall with a support structure disposed in the sidewall;

the sidewall having an inner surface and an outer surface;

an electronic device mounted to the inner surface of the sidewall;

an antenna mounted to the tire sidewall in a location spaced from the electronic device; the antenna being in electrical communication with the electronic device; and

a portion of the support structure being disposed intermediate the antenna and the electronic device.

20. The tire of claim **19**, further comprising a connector that provides at least a portion of the electrical communication between the antenna and the electronic device; the connector passing through the support structure of the sidewall.

21. The tire of claim **19**, further comprising a connector that provides at least a portion of the electrical communication between the antenna and the electronic device; the connector disposed around the support structure of the sidewall.

22. The tire of claim **19**, wherein the antenna is embedded within the sidewall.

23. The tire of claim **19**, wherein the antenna is carried by the outer surface of the sidewall.

24. The tire of claim **19**, further comprising a connector that provides at least a portion of the electrical communication between the antenna and the electronic device; the connector being physically detached from the electronic device while being electrically coupled to the electronic device to provide electrical communication between the antenna and the electronic device.

25. The tire of claim **19**, further comprising a connector that provides at least a portion of the electrical communication between the antenna and the electronic device; wherein the connector is physically connected to the electronic device.

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